From Infrared to X-Ray

BMDO Technology Background

NOVA R & D (Riverside, CA) is working on a scanning digital mammography unit with higher spatial resolution, lower radiation, and better display with higher contrast than present mammography methods. The key to the system is a silicon pixel detector (SiPD) developed for BMDO systems at Hughes Aircraft Company (El Segundo, CA). Hughes developed SiPD technology for use in infrared sensors. NOVA proposed a modification of these silicon pixel devices for X-ray detection in digital mammography. The X-ray detector was an adaptation of the infrared sensor technology.

How It Works

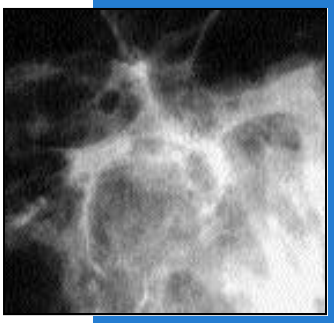
SiPD places thousands of individual detector pixels in a single semiconductor substrate, which is connected to a front-end readout electronics chip with a time-delayed integration-charge-coupled device (TDI-CCD) function. The sections have matching pixel geometry and are electrically connected through an indium bump bonding technique, which allows each diode to be directly connected to its readout electronics. This setup in turn enables the fabrication of small-capacitance and low-noise detectors. NOVA's systems could also be used for bone densitometry and panoramic dental X-rays.

Potential Use to Medicine

Dr. Martin Yaffe of the Sunnybrook Health Science Centre in Toronto has been collaborating with NOVA. Dr. Yaffe's research in digital mammography has helped NOVA in its quest to reduce radiation dosage, eliminate the need for a grid (used in conventional systems to reduce scatter), improve image resolution, and produce a filmless X-ray that can be electronically stored and transmitted. Dr. Yaffe is currently using a scanned slot system with a detector array that is 50 to 500 x 5,000 to 6,000 pixels. The detector is moved in one direction as X-rays are delivered to the breast, capturing incident radiation one section at a time; it takes 1 to 5 seconds to complete the scan. The sections are overlapped to create an image of the whole breast.

Product Status and Availability

NOVA plans to have a prototype silicon-pixel based mammography unit by 1997.



Credit: Dr. Martin Yaffe

▲ An image obtained with a CCD-based scanning digital mammography system.

Silicon pixel technology will offer high-resolution, low-dosage mammography.